this, any others of Ti, Zr, Cr, W, Hf, Nb, their alloys, and their oxides and nitrides are usable for the underlayer.

In the prior art film (f), the underlayer below Au has a total thickness of 220 nanometers. As opposed to this, in this Example, the Ta underlayer is enough to prevent island-like growth of Au and to planarize the Au surface. The interface between Au and the overlying Cu/CoFe film is also planarized. In addition, the film of this Example does not require high-temperature thermal treatment at 350°C. The best thermal treatment to which the film of this Example is subjected is at 270°C and for 4 hours or so. In that thermal treatment, the compositional steepness in the interlayer is kept best. For these reasons, the nonmagnetic underlayer of Ta is important. When combined with any other ordinary underlayer, the Ta underlayer planarizes the Au film formed thereon.

When any of 5 nanometer Ti, 5 nm Zr, 5 nm W, 5 nm Cr, 5 nm V, 5 nm Nb, 5 nm Mo, 5 nm Hf and their alloys (5 nanometer Thick) was used as the nonmagnetic underlayer, the same results as above were also obtained. When any of 0.5 to 2 nm Au/0.5 to 2 nm Cu, 0.3 to 1 nm Au/0.3 to 1 nm Cu/0.3 to 1 nm Au/0.3 to 1 nm Cu, or 0.5 to 5 nm AuCu/0.5 to 2 nm Cu was used as the MR-improving layer, the same results as above were also obtained.

The MR-improving layer may be of a two-layered or even more multi-layered film, or a single-layered alloy film.

However, when it does not contain an additive element capable of increasing resistance and if its thickness is large, the shunt current flow will increase. Therefore, the thickness of the MR-improving layer is preferably at most 5 nanometers. However, it must have an additional seed effect for fcc orientation as the underlayer, it is desirable that the MR-improving layer to be disposed below the magnetic layer has a thickness of from 2 to 5 nanometers or so.

Except the combination of Au-Cu, other examples of the laminate film and the alloy layer that may be combined with the magnetic layer of a Co-based alloy include Ru-Cu, Au-Cu, Pt-Cu, Rh-Cu, Pd-Cu, Ir-Cu, Ag-Pt, Ag-Pd , Ag-Au, Au-Pt, Au-Pd, Au-Al, etc. In those combinations, the essential element in the MR-improving layer to be disposed adjacent to the Co-based magnetic layer is any of Cu, Au and Ag.

Regarding the film constitution, any of two-layered laminates, such as Au-Cu, Ru-Cu illustrated herein, or three-layered or more multi-layered laminates, or even single-layered or multi-layered alloy films are employable. Regarding the film thickness, the same as that for the film of Au-Cu illustrated herein shall apply to those modifications. When the films do not contain a third element, their thickness is preferably from 2 to 3 nanometers or so in terms of the total thickness.

Preferred combinations to be applied to the Co-based

magnetic layer are Au-Cu, Ag-Pt, Au-Pd, Au-Ag, Pt-Cu and the like, as they ensure microstructure films and as they form solid solution with ease. Of those combinations, the best one ensuring good lattice constant control is determined.

Like in the case where the magnetic layer is of a Co-based material, the combinations for the laminate films or alloy layers for the MR-improving layer to be disposed adjacent to the magnetic layer of an Ni-based material include Au-Pt, Au-Pd, Au-Ag, Au-Al, Ag-Pt, Ag-Pd, Ru-Rh, Ru-Ir, Ru-Pt, etc. In those combinations, the essential element in the MR-improving layer to be disposed adjacent to the Ni-based magnetic layer is any of Au, Ag and Ru. Regarding the film constitution and the film thickness, the same as that for the Co-based magnetic layer could apply also to the case of the Ni-based magnetic layer.

The two elements constituting the MR-improving layer may be those not forming solid solution. For example, in the case of Co-based magnetic layer, the MR-improving layer may be of a laminate film of Cu-Ru or Cu-Ag. Those combinations not forming solid solution are not suitable for alloy layers. This is because alloy layers of those combinations will readily give separated two phases. Therefore, those combinations are preferably used for laminate films. Specific examples of the Ni-based magnetic layer include NiFe, NiFeCr, NiFeNb, NiFeRh, etc.

Regarding the pinned magnetic layer constitution, the